EPSC Abstracts,
Vol. 4, EPSC2009-419, 2009
European Planetary Science Congress,

Evolution of exposed ice in fresh low-latitude craters on Mars

K.J. Kossacki (1) and G. Portyankina (2)

(1) Warsaw University, Institute of Geophysics, Poland (kjkossac@igf.fuw.edu.pl) (2) University of Bern, Switzerland (portyankina@space.unibe.ch)

Abstract

Recent observations of the surface of Mars have shown several fresh mid- to low latitude craters. Surprisingly, some of these craters show exposed ice [1]. In some craters albedo of ice exhibits clear dependence on time. We performed numerical simulations to investigate evolution of the exposed ice in the craters, where the exposed ice was discovered. We attempt to determine influence of the regolith structure on the rate of sublimation of ice.

Model

The numerical model used in this work describes condensation and sublimation cycle of ices within a cylindrical flat floor crater. Following phenomena are included into the model: the variable illumination, infrared emission, heat transport beneath the surface and the energy losses due to sublimation or condensation. The flux of absorbed light depends on the local orientation of the facet (wall or bottom) and on the current position of the Sun. The latter evolves due to orbital motion and rotation of Mars. We consider direct solar light, as well as light scattered once within the crater. Condensation or sublimation of H_2O is determined by the local surface temperature and the current near-surface density of vapor in the atmosphere. The latter is taken from the results of LMD/Oxford GCM results [2]. Illumination of the crater is calculated in three dimensions. The heat transport in the regolith is calculated in cylindrical coordinates, but for computational reasons only in two dimensions: vertical and radial (eight directions from the center of the crater).

Results

We have found, that the net sublimation rate of the ice present on the floor of small mid latitude crateters significantly depends on thermal properties of regolith beneath the craters. Our model assumes immediate formation of a crater with some layer of the exposed water ice at the crater floor. The initial temperature of the regolith is uniform, because warming of the regolith during impact that created the considered crater is unknown. In Fig. 1 we shown profiles of the ice thickness versus time. The free parameter is volume fraction of ice in the regolith. Presence of the subsurface ice significantly increases thermal inertia. However, high values of the thermal inertia can result also from large grain size and strong consolidation of the regolith.

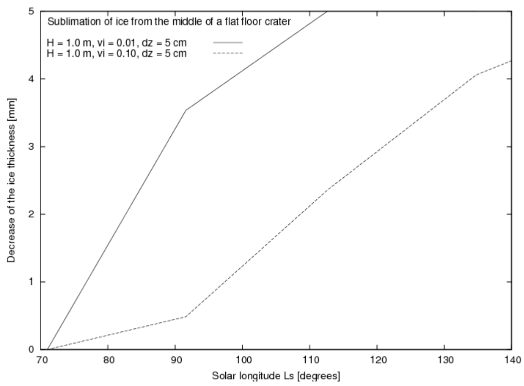

Figure 1 Preliminary simulations of the ice thickness versus time.

References

[1] Byrne S. et al. (2009) *LPSC* abstract [2] Forget F. et al. (1999) *JGR* 104, 24155-24176 [3] Lewis S.R. Et al. (1999) *JGR* 104, 24177-24194.